High Power Flexible Solar Blankets

Naval Research Laboratory

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At a Glance

What is it?

NRL is developing photovoltaics (solar cells) that combine high power output with lightweight and flexibility.

How does it work?

Crystalline, high efficiency, multi-junction solar cells are lifted off the growth substrate and laid-down onto a lightweight, flexible blanket. This forms a blanket with potentially 3x the power output of current technologies.

What will it accomplish?

Producing high powered solar blankets will enable man-portable power that will displace battery weight for the dismounted soldier.

Flexible solar blanket of aSi solar cells.

Commercial solar blankets are based on thin-film solar cell technologies that are inherently low efficiencies (~10%).

For space applications, solar cells with efficiencies approaching 35% are being developed. These are inverted metamorphic (IMM) triple junction (3J) solar cells, and these are being developed in a manner that renders the active solar cell material as a thin membrane which can be laid down onto a flexible substrate. This break-through solar cell technology now enables the simultaneous attainment of high W/kg and W/m^2 in a flexible array.

To capitalize on this, the space solar technology must be adapted for terrestrial applications, which entails adapting the internal solar cell structure for the terrestrial solar spectrum. In addition, the solar array technology must be developed to form a flexible blanket. This requires development of interconnecting schemes and laminating methods to form a blanket that is rugged and robust.

Mobile Solar Power being tested by Marines dring a Limited Objective Experiment.

NRL seeks to exploit the marked advantages of the IMM 3J technology to produce small scale power technologies that can easily and rapidly be scaled up to meet larger power requirements. This technology has direct & positive spin off commercial applications to increase the availability of electrical power in remote locations and reduce dependence upon fossil fuels and concurrent risks to troops convoying such fuel. Also, when in full scale production, this will lead to large growth in "green" employment.

Research Challenges and Opportunities

- Design IMM 3J solar cells for operation in a terrestrial environment
- Develop array technologies needed for a rugged, flexible solar blanket

List of publications:

“NRL Charges Marine Corps Expeditionary Power Requirements”, //2012 - NRL Press Release 50-12r, Contact: Daniel Parry, (202) 767-2326

Kelly M. Trautz, Phillip P. Jenkins, Robert J. Walters, David Scheiman, Raymond Hoheisel, Rao Tatavarti, Ray Chan, Haruki Miyamoto, Jessica G.J. Adams, Victor C. Elarde, and James Grimsley, "Mobile Solar Power," Technical Digest of the 38th Photovoltaic Specialist COnference (PVSC). Austin, TX June 2012

Kelly M. Trautz, Phillip P. Jenkins, Robert J. Walters, David Scheiman, Raymond Hoheisel, Rao Tatavarti, Ray Chan, Haruki Miyamoto, Jessica G.J. Adams, Victor C. Elarde, and James Grimsley, "Mobile Solar Power," IEEE Journal of Photovoltaics, January 2013